Remarks

Applicants are filing this Amendment along with a Request for Continued Examination. Claims 17, 19-28, 30-40 and 67-75 are pending. Applicants have requested amendments to claims 17, 24, 30 and 74 to address rejections under 35 U.S.C. § 112 and to recite features that further distinguish documents cited against this application from embodiments of applicants' invention as recited in the pending claims. Applicants request reconsideration of this application in view of the foregoing amendments and following remarks.

I. Claim Objections

Applicants have amended claim 30 to depend from independent claim 24, and hence the objection to claim 30 should be withdrawn.

II. Rejections under Section 112, First Paragraph

Claims 73 and 74 are rejected as allegedly failing to comply with the written description requirement. Applicants traverse the Section 112 rejections of these claims and request that the rejections be withdrawn.

Preloading components of applicants' bonding unit with a bonding pressure, such as the load cell, is discussed at several locations in the application. By way of example, please consider the following exemplary passages from the application as filed.

> Bonding includes heating the thermally assisted bonding device such that the heat causes the engager to expand relative to the top plate and bottom plate and at a given time after heating the engager engages both the top plate and laminae and a final bonding pressure stored in the spring is applied to laminae.

Page 4, lines 9-13.

> The expansion cylinders may have different lengths, or the cylinder lengths in a particular embodiment may be adjustable, for differential application of pressure to workpiece or different coefficients of thermal expansion.

Page 4, line 30 through page 5, line 3.

> The fixture or thermal clamping unit can be adjusted for use with different material systems. Different materials need different pressures to register and bond and have different CTEs. For that reason, certain disclosed embodiments of the clamping

unit should be adjustable to allow application of different preselected pressure levels to workpieces.

Page 22, lines 13-17.

Another embodiment of a fixture 130 is shown in FIG. 12, spring 260 is preloaded to the desired final pressure level. Spring 250 in an unloaded state is held by fastener 280 and positioned between base plate 290 and load stage plate 270. The appropriate amount of preload force is then applied to the load stage plate with a weight or a hydraulic press and the fastener 280 is tightened to secure a predetermined amount of spring compression.

Page 26, lines 1-6.

Spring 250 in an unloaded state is held by fastener 280 and positioned between base plate 290 and load stage plate 270. The appropriate amount of preload force is then applied to the load stage plate with a weight or a hydraulic press and the fastener 280 is tightened to secure a predetermined amount of spring compression.

Page 26, lines 2-6.

The pressure magnitude and sensitivity is controlled by using a preloadable load stage 850 with springs, particularly high temperature springs 860.

Page 42, lines 2-3.

Based on the above, components of the bonding device clearly can be preloaded with a bonding pressure, and hence claims 73 and 74 are supported by the specification as initially filed. Applicants therefore request that the rejections of claims 73 and 74 under Section 112 be withdrawn.

Applicants also disagree that the application fails to teach using a fluidic load cell. However, solely to facilitate prosecution of the present application, applicants have amended claim 74 to state that the method includes using a fluidic device to apply a bonding pressure to the laminae. The application does discuss using fluidic devices to apply bonding pressure to laminae. For example, the application states the following:

One embodiment of a bonding fixture based on the principle of thermal expansion for the application of bonding pressure is shown in FIG. 6. The bonding fixture 90 consists of a frame 130 having a bottom plate 100, a top plate 110 and frame posts 160. The fixture 90 includes an engager 120 interposed between bottom plate 100 and top plate 110, where the engager can be, but is not limited to, an engagement block, an expansion cylinder, a fluid expander or any combination thereof. The bottom and top

plates, structurally connected by frame posts 160, represent a rigid frame 130. In one embodiment, the frame posts 160 are adjustable for adjusting the height of the frame. The engager 120 has a higher coefficient of thermal expansion than the frame 130 of the fixture 90. The coefficients of thermal expansion (CTE) should preferably differ at least by a factor of two. Generally, the height of the engager 120 is directly proportional to the amount of clamping pressure to be delivered. The laminae 140 are placed and aligned between the engager and the bottom plate. Preferably, the laminae 140 are placed between bonding platens 150. When the bonding fixture 90 is heated to the bonding temperature (T_B), the engager 120 and the platens 150 inside the frame expand relative to the frame by the difference in the sum of their coefficients of thermal expansion multiplied by the product of the height of the engager/platens and the change in temperature. An initial gap (g_0) can be designed into the fixture assembly to scale and time the application of the bonding pressure. As soon as the volume of the initial gap is occupied as the engager and platens expand due to the differential expansion behavior, e.g., when top plate of the frame and inner parts come into contact, compression is applied to the laminae. The compression force increasing with increasing temperature.

Page 14, lines 7-30.

In FIG. 33, the fixture 800 includes a gas/liquid expander 820. Gas/liquid expander 820 includes a bellows 830 filled with a fluid 840, which may be a liquid or a gas, with a much higher thermal expansion compared to the fixture frame 810. The pressure magnitude and sensitivity is controlled by using a preloadable load stage 850 with springs, particularly high temperature springs 860. Pressure engagement (pressure timing) is controlled by the volumetric expansion of the bellows 830 due to the temperature rise from room to bonding temperature. Initial gap settings can be controlled by setting a primary level of pressure inside the bellows 810 using an inlet valve 870. Additionally, if a preset pressure threshold is reached, any excess pressure is relieved through a pressure relief valve (not shown). In this way, the pressure sensitivity of fixture 800 can be further reduced by setting an upper pressure limit. Furthermore, the use of a gas/liquid expander provides a more uniform pressure engagement over large substrate areas up to at least 576 in^2 and promotes a fixture design that is more durable, smaller (e.g. smaller profile) and lighter (e.g. lower thermal mass and/or weight), which is important , amongst other reasons, for the selection of the conveyor.

Page 41, line 31, through page 42, line 14.

III. Rejections under Section 112, Second Paragraph

Claims 17, 19-23, 30-34, 66-67 and 73 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Applicants traverse the rejection of these claims under 35 U.S.C. § 112, second paragraph, and request that the rejections be withdrawn.

Applicants have amended claim 17 to expressly recite the interpretation stated by the Examiner.

Applicants disagree that claim 73 is indefinite. The several exemplary passages quoted above from the application as filed clearly establish how a load cell can include a predetermined amount of pressure for application to laminae in a stack. Applicants therefore request that the rejection of claim 73 be withdrawn.

IV. Rejections under Section 102

Claim 67 is rejected as allegedly being anticipated by U.S. Patent No. 4,689,108 (Barry). Applicants traverse this rejection and request that it be withdrawn.

Applicants respectfully point out that claim 67 depends from independent claim 17. This rejection is improper for this reason alone, and applicants request that it be withdrawn.

Moreover, applicants also disagree that Barry anticipates the combination of features recited in independent claim 17, and the combination of features of independent claim 17 and 67. The technology disclosed and claimed in the present application is, for certain embodiments, directed to bonding laminae together at relatively high temperatures. As a result, the bonding unit with associated laminae are placed inside a heated furnace to achieve the bonding temperatures required to bond together plural laminae to form an integral workpiece or at least a portion thereof. Applicants have amended claim 17 to affirmatively recite placing the thermally assisted bonding unit and laminae in a furnace, and heating the laminae in the furnace. This feature clearly is not taught by Barry, and hence the rejection of claim 67, and the claims that depend therefrom, must be withdrawn.

Independent claim 17, and hence claim 67, also is non-obvious in view of Barry. Barry does not contemplate using his device for high temperature bonding applications, and does not teach or suggest inserting the bonding unit into a furnace for high temperature bonding applications. Barry's device does include an integral heating component, i.e. sealing member 34. Barry states that member 34 can "support resistivity heated elements mounted in an aluminum block curved to fit against the workpiece." Barry, column 2, lines 36-37. However, such resistivity units would not be sufficient for high temperature bonding applications. And, the fact that the device includes integral heating components supports the conclusion that Barry does not suggest heating a workpiece associated with the Barry device in a furnace.

Furthermore, the Barry device includes many moveable parts that move relative to one another, such as turntables 15 and 32. Heating such moveable components at high temperature in a furnace would be problematic, as such parts likely would seize, and therefore, cease relative movement upon heating in the furnace. Based upon these structural considerations of the Barry device, it is clear that Barry did not contemplate using the device for high temperature applications, and does not teach or suggest inserting the device and associated components into a furnace to heat them to high bonding temperatures.

The Office action also asserts that Barry discloses a "pressure regulating spring" and that this apparently is the same as applicants' load cell. Applicants disagree. According to Barry, "[c]oil springs 30, 31 urge third plate 27 back toward second plate 10 (sic., 20) when hydraulic pressure is relieved." Barry, column 2, lines 20-21. These springs are not load cells, as they are not preloaded with pressure that allow timed application of bonding pressure to a workpiece.

Claim 67 depends from independent claim 17 and is allowable for the reasons stated for claim 17, and further in view of the patentable combinations of features recited in such claims. The rejection of claim 67 under U.S.C. § 102(b) over Barry therefore should be withdrawn.

V. Rejection of Claims 17, 19 and 23

Claims 17, 19 and 23 are rejected as allegedly being obvious under 35 U.S.C. § 103 over McHerron *et al.*, U.S. Patent No. 6,892,781 (McHerron). Applicants traverse this rejection and request that it be withdrawn.

Applicants have amended claim 17 to address the timing of applying a bonding pressure to the workpiece using the thermally assisted bonding unit as disclosed and claimed in the present application. These amendments further point out distinctions between applicants' claimed embodiment and the technology disclosed in the references cited against the present application. Specifically, applicants have amended claim 17 to recite that the method comprises "loading laminae in a thermally assisted bonding unit, placing the thermally assisted bonding unit and laminae in a furnace, heating the laminae and the bonding unit in the furnace to ± 50 °C of a bonding temperature, and applying a bonding pressure to the laminae using the thermally assisted bonding unit, wherein a timing application of the bonding pressure is determined by adjusting fluid mass in the fluid expansion unit."

Support for amending certain claims of the present application, including independent claim 17, to refer to applying a bonding pressure within about ± 50 °C of a selected bonding temperature is provided in paragraph 172 of the application as published. Substantial disclosure is provided in the present application concerning applying a bonding pressure to plural laminae at a particular time in the heat ramp cycle in order to avoid fin warpage. Furthermore, the application discloses adjusting the timing of applying bonding pressure by adjusting the fluid mass in the fluid expansion unit. See FIG. 33 for example.

McHerron does not teach or suggest adjusting the timing associated with applying a bonding pressure using a fluid expansion unit to apply pressure to plural laminae. Based upon an electronic word search, McHerron never uses the word "timing." Furthermore, with respect to the disclosure associated with FIG. 4 at column 6, beginning at line 9, there is no disclosure by McHerron concerning adjusting fluid mass in a fluid expansion unit to time the application of a bonding pressure to plural laminae. For this reason, independent claim 17 is not anticipated by McHerron.

Claim 17 also is not obvious in view of McHerron. The present application is primarily directed to bonding plural laminae together to form a microfluidic device or a portion of a device comprising a microfluidic channel. Fin warpage is a substantial issue associated with such workpieces. As substantiated by Mr. Pluess' thesis as submitted previously to the PTO, the timing of applying bonding pressure to such laminae has a substantial impact on warpage. Because McHerron does not address microfluidics, and is entirely silent as to the issue of applying the bonding pressure at a particular heat ramp time to such devices, McHerron also does not render obvious the embodiment as recited in applicants' independent claim 17.

Claims 19 and 23 depend from independent claim 17, and are allowable for the reasons stated above with respect to claim 17, and further in view of the patentable combination of features recited in these claims.

Furthermore, the Barry device includes many moveable parts that move relative to one another, such as turntables 15 and 32. Heating such moveable components at high temperature in a furnace would be problematic, as such parts likely would seize, and therefore, cease relative movement upon heating in the furnace. Based upon these structural considerations of the Barry device, it is clear that Barry did not contemplate using the device for high temperature

applications, and does not teach or suggest inserting the device and associated components into a furnace to heat them to high bonding temperatures.

The Office action also asserts that Barry discloses a "pressure regulating spring" and that this apparently is the same as applicants' load cell. Applicants disagree. According to Barry, "[c]oil springs 30, 31 urge third plate 27 back toward second plate 10 (sic., 20) when hydraulic pressure is relieved." Barry, column 2, lines 20-21. These springs are not load cells, as they are not preloaded with pressure that allow timed application of bonding pressure to a workpiece.

Claims 29-30 and 67 depend from independent claim 17 and are allowable for the reasons stated for claim 17, and further in view of the patentable combinations of features recited in such claims. The rejection of claims 17, 29-30, and 67 under U.S.C. § 102(b) over Barry therefore should be withdrawn.

VI. Rejection of Claims 20-22

Claims 20-22 are rejected as allegedly being obvious under 35 U.S.C. § 103(a) over McHerron and further in view of Ally *et al.*'s U.S. Patent No. 5,232,145 (Ally). Applicants traverse this rejection and request that it be withdrawn.

As discussed above, applicants have amended independent claim 17, from which claims 20-22 depend, to require timing of the bonding pressure applied by the thermally assisted bonding unit. McHerron does not teach these features.

Ally does not cure the deficiencies of McHerron relative to teaching or suggesting the features of independent claim 17, from which the rejected claims depend. Claims 20-22 add features associated with heating, such as convective heating, including using an inert gas. Ally is almost entirely directed to the concept of soldering in a reflow furnace, and therefore describes in detail the structure of the reflow furnace and the method for its operation.

Ally provides no disclosure concerning using a bonding unit as recited in independent claim17, from which rejected claims 20-22 depend. Hence Ally cannot provide any disclosure concerning using such a device to time the application of bonding pressure to form a workpiece. As a result, claims 20-22 are allowable in view of the combination of McHerron and Ally, and applicants request that the rejection of these claims be withdrawn.

VII. Rejection of Claims 30-33 and 66

Claims 30-33 and 66 are rejected as allegedly being obvious under 35 U.S.C. § 103(a) over McHerron and further in view of Callahan *et al.*'s U.S. Patent Publication No. 2005/0007748 (Callahan). Applicants traverse this rejection and request that it be withdrawn.

Claims 30-33 and 66 also depend from independent claim 17 as amended and discussed above. Callahan clearly provides no discussion of a thermally assisted bonding unit comprising at least one fluid expansion unit. Callahan therefore cannot cure the deficiencies of McHerron relative to teaching timing the application of bonding pressure by adjusting the fluid mass in a fluid expansion unit such that the unit applies bonding pressure at a desired time subsequent to initiating a heating cycle. Claims 30-33 and 66 therefore are not obvious in view of the combination of McHerron and Callahan for the reasons stated above for claim 17, and further in view of the patentable combination of features recited in these claims.

VIII. Rejection of Claim 34

Claim 34 is rejected as allegedly being obvious under 35 U.S.C. § 103(a) over McHerron *et al.* Applicants traverse this rejection and request that it be withdrawn.

The deficiencies of McHerron relative to independent claim 17, from which claim 34 depends, are discussed above. As a result, claim 34 is allowable under 35 U.S.C. § 103(a) over McHerron.

IX. Rejection of Claims 35, 38-40 and 72-73

Claims 35, 38-40 and 72-33 are rejected under 35 U.S.C. § 103(a) as allegedly being obvious over McHerron in view of U.S. Patent Publication No. US 2004/0012122 (Nagaoka) and U.S. Patent Publication No. US 2004/0086427 (Childers). Applicants traverse this rejection and request that it be withdrawn.

McHerron does not teach or suggest a thermally-assisted loading unit comprising a load cell, nor the method for using such a device as recited in independent claim 35. Childers is cited solely as teaching forming a microfluidics device from a stack of multilayer thin films. Even if this characterization of Childers is correct, it does not address the deficiencies of McHerron, the primary reference, with respect to the features recited in independent claim 35.

Nagaoka concerns an injection and compression molding machine, not a device for making a microfluidic device from plural laminae when such laminae are prone to buckle when a bonding pressure is applied. A prior art combination for purposes of Section 103 is improper if a person of ordinary skill in the art would have no reasonable expectation of success to obtain features of a recited claim. The problems inherent with bonding laminae to form a fluidic device having microchannels are not associated with injection molding methods, and therefore a person of ordinary skill in the art would not expect to simply use aspects of the Nagaoka device to solve problems associated particularly with bonding plural laminae to form a microfluidic device. The combination therefore cannot teach or suggest the features of claim 35. As a result, claims 36-37 are allowable for the reasons stated for independent claim 35, and further in view of the patentable combination of features recited in these claims.

X. Rejection of Claims 36-37

Claims 36-37 are rejected under 35 U.S.C. § 103 over McHerron, Nagaoka, Childers and Ally in combination. Applicants traverse the rejection of claims 36-37 under 35 U.S.C. § 103, and request that this rejection be withdrawn.

Each of the references cited to support the present rejection of claims 36-37 are addressed above, as well as are the deficiencies of these references with respect to the features of the claimed invention. For this reason alone, claims 36-37 are allowable over the prior art.

Furthermore, in order to allegedly arrive at all features of claims 36-37, the Office action had to rely on four separate references. While applicants understand that there is no *per se* prohibition against the number of references required to support an obviousness rejection, as the number of references increases, it is clearly an indication of the nonobviousness of the invention. Applicants assert that having to rely on four independent references to allegedly teach the features of the rejected claims is a clear indication that these claims are nonobvious.

XI. Rejection of Claims 68-70

Claims 68-70 are rejected as allegedly being obvious over McHerron in view of Nagaoka. Applicants traverse this rejection and request that it be withdrawn.

The deficiencies of McHerron and Nagaoka with respect to teaching the features of the rejected claims are discussed above. Applicants request that the rejection of claims 68-70 therefore be withdrawn based upon the discussion of the cited references above.

XII. Rejection of Claim 74

Claim 74 is rejected as allegedly being obvious over McHerron, Nagaoka and Childers, and further in view of Schomburg *et al.*'s U.S. Patent Publication No. US 2004/0086427 (Schomburg). Applicants traverse this rejection and request that it be withdrawn.

Each of McHerron, Nagaoka and Childers is discussed above. Schomburg is cited as allegedly teaching disclosure of a spring base load cell formation pressure. However, applicants note that claim 74 states that the unit includes a fluidic device to apply bonding pressure to the laminae. Thus, Schomburg's teaching of a spring base load cell is irrelevant to the features of claim 74 as amended.

Furthermore, the Office action had to rely on four separate references to allegedly teach each of the features of rejected claim 74. Again, as stated above, this clearly is an indication of the nonobviousness of the features of claim 74, and applicants request that the rejection of claim 74 be withdrawn.

XIII. Rejection of Claim 75

Claim 75 is rejected as allegedly being obvious over McHerron, Nagaoka and Childers, and further in view of Johnson's U.S. Patent No. 5,313,023 (Johnson). Applicants traverse this rejection and request that it be withdrawn.

In order to allegedly teach each feature of claim 75, the Office action relies on four separate references. As stated above, this clearly is an indication of the nonobviousness of claim 75, and applicants request that this rejection be withdrawn.

XIV. Allowable Subject Matter

Claim 71 is objected to as being dependent upon a rejected base claim. In response, applicants have amended claim 71 to include the features of the independent claim. Thus, claim 71 is in condition for allowance.

XV. Claims 24-28

Applicants confirm that claims 24-28 are in condition for allowance. Applicants have made a minor amendment to claim 24 to correct an obvious typographical error.

XVI. Conclusion

Applicants respectfully request that all pending rejections be withdrawn and that a notice of allowance be entered as to all claims. Please contact the undersigned by telephone if such contact would further the examination of the present application.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

One World Trade Center, Suite 1600
121 S.W. Salmon Street
Portland, Oregon 97204
Telephone: (503) 595-5300
Facsimile: (503) 595-5301

By _____
Stacey C. Slater
Registration No. 36,011